

work of Ross, Grassi, and others during the last few years, we find him talking of *Eucalyptus globulus*, and telling us that "Laveran and others claim that the disease is produced by certain microorganisms allied to the Flagellata, but this is contested by Tommasi-Crudeli." Certainly this is a book that requires to be read with discrimination. C. S.

Étude sur les Foudroiements d'arbres constatés en Belgique pendant les Années 1884-1906. By E. Vanderlinden. Pp. 79. (Bruxelles: L'Observatoire Royal de Belgique, 1907.)

A PHENOMENON of very frequent occurrence, and one that has been much studied, is the injury occasioned to trees by lightning, and yet we have no satisfactory explanation of the many difficulties that the problem presents. It must be admitted that these inquiries have not always been pursued on scientific lines, and the facts that have been collected and the theories that have been suggested need a thorough sifting and examination. This is the task to which M. Vanderlinden has applied himself with very considerable success. If he has not satisfied curiosity in all directions, he has at least overthrown some popular errors, limiting and indicating the field of strictly useful inquiry.

It has long been held that some trees are not liable to be struck by lightning. M. Vanderlinden examines this assertion, and finds that in Europe no kind of tree is free from this damage. Some kinds, such as the oak, the poplar, and some species of fir, are more frequently injured than others, but there are not sufficient data to show how far this result is effected by situation, by size, by exposure, or by the greater number cultivated. The causes which may be expected to influence the selective power of lightning are also investigated, but with only negative results. Among these we find the character of the soil, the chemical constitution of the timber, the proximity of water surface, the formation of the leaf, the shape of the tree, and particularly the character of the bark. In this last, the author thinks that possibly we have a source of explanation that has not been sufficiently examined. Trees possessing a smooth bark, such as beeches, are less liable to be struck than those having irregular, rugged, roughened surfaces, the external portions of which, becoming dry and dead, are bad conductors of electricity.

Other questions discussed are the manner in which lightning affects the tree, the character of the so-called spiral injuries, the actual combustion of the tree material, and the manner in which men and animals suffer injury when in the neighbourhood of trees that have been struck. The whole forms an admirable examination of a very scattered literature, and accurately exhibits the present position of an unexhausted inquiry. Detailed tables accompany the paper giving information concerning the locality, the number, and variety of trees, reported as being struck by lightning in the years under review.

The Laws of Health. A Handbook on School Hygiene. By Dr. Carstairs G. Douglas. Pp. vii+240. (London: Blackie and Son, Ltd., 1907.) Price 3s. net.

THIS should prove a useful book for school teachers and others interested in the important subject of school hygiene. Anatomical and physiological details are briefly dealt with, as the author justly remarks that there are several excellent manuals dealing with these subjects. On the other hand, the really important and fundamental portions of hygiene as applied to school life, such as ventilation, warming and lighting, and the fittings of the school buildings, the nutrition, ailments and deformities of the pupils, are discussed with sufficient fulness, and these sections are copiously

illustrated with diagrams and drawings. In dealing with fatigue, we are glad to see the stress the author lays on a proper amount of sleep, and that he ascribes a good deal of the listlessness and inattention, &c., met with in public elementary schools to deficient sleep. We have nothing but praise for the chapters on the slight ailments of children, the eye and ear, and infectious diseases; even the "fourth disease" is referred to. The only omission we have noted is a reference to the cleansing and periodical disinfection of school premises. R. T. H.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

The Wehnelt Kathode in a High Vacuum.

THE interesting experiments on the Wehnelt kathode in a high vacuum described by Mr. Soddy in NATURE for November 21, 1907 (p. 53), do not, I think, necessarily conflict with the experiments of either Dr. Wehnelt or myself, nor do they appear to vitiate the conclusions we drew from them.

The experiments by which Dr. Wehnelt showed that the negative leak from a lime-covered kathode was independent of the gas pressure were made with currents much smaller than those used by Mr. Soddy. When currents of the order of an ampere per square centimetre of kathode surface are obtained, the phenomenon appears to be accompanied by a glow round the kathode implying that ionisation in the gas itself is playing a part. Prof. J. J. Thomson ("Conduction of Electricity through Gases," second edition, p. 477) has shown that the potential fall required to produce ionisation by collisions with these large currents decreases rapidly as the current increases, so that even the comparatively small fall of 30 volts quoted from Wehnelt's paper would be sufficient to produce a considerable effect of this kind.

When the pressure of the gas falls below the value required to maintain this glow under the assigned conditions as to difference of potential, pressure, &c., there will be a sudden drop in the value of the discharge current. This appears to be what Mr. Soddy has observed.

I do not wish to imply that the negative emission is in all circumstances independent of the presence of gas in the tube. It is well known that the negative discharge from hot metals is particularly sensitive to hydrogen. In a recent paper (Phil. Trans., A, vol. ccvii., pp. 53 *et seq.*) I have described experiments which seem to prove conclusively that the leak from hot platinum is not due to traces of absorbed hydrogen. As the experiments in gases other than hydrogen show that the negative leak from hot platinum is independent of the pressure at low pressures, it is very unlikely that it is caused primarily by traces of any other of the common gases. These gases only appear to increase the fundamental electronic discharge from the hot kathode by a process involving the occurrence of ionisation by collisions.

The foregoing explanation of Mr. Soddy's result is only offered as a suggestion, for two reasons. In the first place, Mr. Soddy's letter is not sufficiently definite as to some of the salient facts, as, for example, the magnitude of the pressure before the current dropped. In the second place, there is a good deal about the behaviour of these Wehnelt kathodes which is imperfectly understood, and which merits further investigation.

O. W. RICHARDSON.

Princeton, N.J., December 7, 1907.

I AM glad to learn Prof. Richardson's view is much the same as that expressed in my letter to NATURE of November 21, 1907, that the currents in question are carried mainly by the residual gas, not by the electrons expelled from the kathode. Into the views that have been expressed in earlier communications it is therefore un-

necessary to enter; but certainly Prof. J. J. Thomson has recognised the important part played by the residual gas, for example, in his lecture reported in *NATURE* of March 22, 1906. So far as I have yet been able to see, the action of the residual gas in the passage of large currents is much the same whether a Wehnelt kathode or an ordinary electrode is used. There appears to be a definite pressure at which the conductivity is a maximum, and a steady diminution of conductivity when this pressure is either increased or diminished. I do not think, with large currents at least, there is a sudden drop in the discharge current when the pressure is gradually reduced. Of course in the experiment I quoted there was a sudden cessation of the current, but then there is a sudden absorption of the residual gas when the calcium volatilises. The practical difficulties in the way of maintaining a high vacuum in an apparatus containing incandescent bodies by ordinary methods probably led to the earlier view that it was possible to make a vacuum a good conductor by use of an incandescent kathode.

F. SODDY.

British Association Seismology.

AN ancient Bogle has again appeared upon the scene. The object it has in view is to show that the seismological work done by the British Association is practically useless. It owes its existence to Prof. Bruno Weigand, of the Strassburg Kais. Hauptstation für Erdbebenforschung, and it was introduced to the notice of seismologists as a "Begrüssung" at the second International Seismological Conference. On this occasion, as a welcome to the British and other delegates, Dr. Weigand dilated at considerable length upon the defects of the instruments used by those who had kindly cooperated with the British Association. At Strassburg a Milne pendulum did not record so many earthquakes as a pendulum of the Reubeur-Ehlert type, and the records from the first of these instruments indicated very late commencements.

This statement, which month after month and year after year Strassburg has published in the form of registers, has just been emphasised in two new works on seismology, "*La Science séismologique*," by Comte de Montessus de Ballore, and "*Earthquakes*," by Prof. W. H. Hobbs. These gentlemen, who I do not think claim to have any practical acquaintance with seismology, candidly tell us that their information came from others. What Dr. Weigand has said about his experiences at Strassburg is no doubt absolutely correct. It is not, however, sufficiently complete; he ought to have added that, although records were not being obtained at Strassburg, they were being obtained from similar instruments in Britain and at stations in other parts of the world. As to whether a seismograph gives satisfactory results or not depends upon its foundation, its adjustment, and, amongst other things, upon the light which is used for photographic purposes. If the light is too high, halation steps in, and all small vibrations are eclipsed in a broadened line.

As Dr. Weigand correctly points out, a factor of great importance connected with the working of a seismograph is the speed with which record-receiving surfaces move. In the early form of the Milne instrument, unless great care was exercised with regard to the light and adjustment of the boom, in consequence of the slowness with which the paper moved, very small earthquakes or preliminary tremors might be lost by the thickening of the line. In the modern form of record-receiving surface, now in use for some years, where the paper moves at 24 cm. per hour, nothing of this sort takes place. The seismograph remains exactly as it was first designed, and with its new recording surface yields results as useful and accurate as those obtained from any other type of instrument, and this it does at a cost of less than 3*l.* per annum. An instrument of higher sensibility than the Milne pendulum cannot be used on soft ground, whilst one which uses a very large quantity of photographic paper per year is beyond the means of small observatories. I am quite content to continue with the instrument I now possess, and, in spite of all criticism, I have no desire to change the same.

JOHN MILNE.

Shide, December 30, 1907.

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The Photoelectric Property of Selenium.

IN the letter which appeared in *NATURE* of December 26, Prof. Minchin does not state what kind of air-pump he used to exhaust the tube containing the light-sensitive selenium "bridge." If he used a mercurial pump, the presence of mercury vapour would explain the great fall in resistance observed.

In a paper published many years ago (*Proceedings of the Royal Society*, 1876-7, vol. xxv., p. 22), I showed that mercury combines at ordinary temperatures with selenium, producing a superficial film of comparatively low resistance. This effect is produced with vitreous selenium as well as with the granular or metallic form.

Selenium converted from the vitreous to the metallic form, in a vacuum free from the vapour of mercury, behaves like selenium rendered light-sensitive in the air in the ordinary way (Draper and Moss, *Transactions of the Royal Irish Academy*, 1876, vol. xxvi., p. 231). A specimen prepared *in vacuo* was found to have a high resistance, attributable, no doubt, to its spongy form; it was, however, highly sensitive to light.

RICHARD J. MOSS.

The Laboratory, Royal Dublin Society, December 27, 1907.

PROF. MINCHIN'S observation (p. 173) that the resistance of his selenium cells, or "bridges," when placed *in vacuo*, becomes enormously diminished is strongly suggestive of internal contact or short circuit, possibly brought about mechanically by the expansion of a small body of confined air in some part of the arrangement. Such short circuits occur not infrequently under ordinary conditions, and may generally be burnt out, and the cell restored to its original state, by the application for a moment of an E.M.F. of 50 volts or 100 volts.

Selenium cells have often been tested in a vacuum. They are supplied commercially, enclosed in highly exhausted glass tubes, by Dr. Ruhmer, of Berlin.

SHELFORD BIDWELL.

Beechmead, Otlands Chase, Weybridge,
December 30, 1907.

Echelon Spectroscope.

WHILST employing a thirty-three plate echelon spectro-scope, constructed by Messrs. Adam Hilger for Prof. Schuster, my attention has been directed to a feature of the instrument which needs to be considered in drawing conclusions as to the nature of the light. Using an Arons mercury lamp as the source of light, the bright green line, for example, is resolved by the echelon into a bright and broad principal line with narrower companion lines on either side, and the principal line sometimes shows a narrow dark line not far from its centre.

Like others who seem to have observed the same effect, I supposed that the principal line showed reversal until I found that, on rotating the echelon slowly about a vertical axis, the dark line moves across the broad bright line, and disappears at the side; then another dark line appears at the opposite side, moves across, and disappears like the first; and so on.

These effects are probably produced by interference bands that have not been considered in the theory of the echelon, but have been described by Gehrccke ("*Über eine Interferenzerscheinung am Stufengitter*," *Annalen der Physik*, xviii., p. 1074, 1905).

If the echelon is tilted about a horizontal axis, parallel to the plates, these secondary bands become more inclined to the vertical, that is, to the direction of the slit, than the ordinary spectrum lines, and their mutual intersection gives to the spectrum lines a screw-like appearance.

A further investigation of these bands is being made, and it is hoped shortly to publish additional details of their behaviour that may help to explain their origin.

H. STANSFIELD.

The University, Manchester, December 26, 1907.

A Point in the Mathematical Theory of Elasticity.

PROF. PEARSON has recently made a statement which if correct is of very great importance to engineers. He declares that the distribution of the stresses due to the water pressure on, and the weight of, a dam is entirely different in the case of a thin slab cut from the dam